BIBLIOGRAPHICAL NOTICE.

A Manual for the Study of Insects. By John Henry Comstock, Professor of Entomology in Cornell University and in Leland Stanford Junior University; and Anna Botsford Comstock, Member of the Society of American Wood-Engravers. 8vo. Ithaca, N. Y., 1895. Pp. xii, 701. Coloured frontispiece, 5 plain plates, and woodcuts.

It is no longer possible, as when Fabricius published his 'Systema Entomologiæ' in 1775, to compress the descriptions of all the known insects of the world into a single volume; nor is it possible to compress the results of all the best work on all the orders of insects into two moderate-sized volumes, as was still the case in 1840, when Westwood published his great work on the 'Modern Classification of Insects,' a work still of the greatest value to entomologists, and which could never be superseded except by a whole library written by a very large syndicate of specialists. We have not even any later book dealing with British Entomology on the lines of Westwood's 'Introduction,' our books on general British Entomology being only popular works, chiefly of value to beginners.

But in North America they are more fortunate; for Prof. Packard's 'Guide to the Study of Insects,' first published in 1869, deals with American insects as comprehensively, though somewhat more popularly, than Westwood dealt with the insects of the world; and we are glad to add that the book has been fully appreciated, having run through more editions in a comparatively short time than perhaps any other entomological book ever published. And now Professor Comstock, already known to all entomologists by much valuable work, among which we may specially mention his writings on scale-insects (Coccidæ) and on the neuration of insects, has published a 'Manual for the Study of Insects,' which, though treating almost exclusively of North-American insects, will yet be found indispensable to all students of entomology who study those groups of insects which the author has discussed in adequate detail.

The book is handsomely got up, even as regards the outside, being bound in light grey, with silver lettering, and having a butterfly resting on a flower on the back and a spider's web in the corner of the upper cover. The paper and print are very good; there is a coloured frontispiece representing plants, butterflies, and beetles, and the book is crowded with illustrations, including both woodcuts and plain plates. In fact it is almost too well got up, for it weighs twice as much as would be expected from its size, which cannot be considered an advantage in any book.

Although Prof. Comstock does not include the Crustacea, Arachnida, and Myriapoda among the insects (the two latter are treated by Dr. Packard, with the Insects, as subclasses of Tracheata), yet they receive a brief mention at the commencement of his volume,

the orders of Arachnida and the principal families of spiders being treated almost as fully as some of the smaller orders of insects.

Turning now to the Insects, which form the chief subject of Prof. Comstock's work, we find that he divides them into nineteen orders, instead of the seven into which they are frequently compressed by European entomologists, although Westwood, in 1840, admitted thirteen, exclusive of Thysanura and Parasita (=Anoplura and Mallophaga), which he did not regard as true insects. Prof. Packard, however, admits only eight, including the Thysanura. Prof. Comstock's nineteen orders are as follows:—Thysanura, Ephemerida, Odonata, Plecoptera, Isoptera, Corrodentia, Mallophaga, Euplexoptera, Orthoptera, Physopoda, Hemiptera, Neuroptera, Mecoptera, Trichoptera, Lepidoptera, Diptera, Siphonaptera, Coleoptera, Hymenoptera. Of these the following names are in less general use than the others:—Plecoptera (Perlidæ), Isoptera (Termites), Corrodentia (Psocidæ), Physopoda (Thrips), Mecoptera (Panorpidæ and Bittacidæ), and Siphonaptera (Pulicidæ). The Neuroptera (which name we should prefer to retain for the Odonata) include the families Mantispidæ, Raphidiidæ, Sialidæ, Coniopterygidæ, Myrmeleonidæ, Hemerobiidæ, and Chrysopidæ. Two or three of the old orders admitted by Westwood disappear as orders; thus, the Hemiptera are divided into three suborders—Heteroptera, Parasita (Pediculidæ), and Homoptera—and the Strepsiptera are treated as a family of Coleoptera, as by most recent authors.

Several of these orders are treated very briefly indeed; thus, only four pages are given to the Odonata, or Dragonflies, which are said to form "only a single family." Considering that the Rhynchophora, or Weevils, are treated as a suborder of Coleoptera (though far less anomalous than some of the aberrant Heteromera, the Meloidæ for example), it is strange to see a group of nearly 2000 known species, and containing three main families as distinct as the Libellulidæ, Æschnidæ, and Agrionidæ, dismissed with even less notice than is given to the compact little order of the Siphonaptera or Fleas, and with scarcely an observation of the slightest scientific, or even popular, value. In Prof. Packard's work, which we suppose has served as the model of Prof. Comstock's, the Odonata are much more fully dealt with, although still inadequately.

It must be allowed that it would be unfair to expect the writer of a general work like this to make it equally complete in every group; but it is difficult to account for such a scant notice of such an important group as the Odonata. On the other hand, most of the larger orders are treated of as elaborately as the character of the work and the available space will allow, no less than 222 pages being allotted to the Lepidoptera alone.

Many figures are given of wing-neuration in all the orders, but more especially in the Lepidoptera, which, as is well known, Prof. Comstock proposes to divide into two suborders. The first suborder is the Jugatæ, or Lepidoptera with similar neuration to the fore and hind wings, and with a small lobe projecting from the base of the fore wings beneath the costal margin of the hind wing.

This structure is called the jugum, or yoke, and is found only in the Hepialidæ and Micropterygidæ. The Frenatæ form the second suborder, and include the other families of Lepidoptera, in which the fore and hind wings have different neuration and are connected by a frenulum, a bristle, or bundle of bristles, or by its substitute, a large humeral angle of the hind wing. But it will require a more extensive examination of the neuration of exotic Lepidoptera before we can determine the exact value of these characters, which appear hardly sufficient by themselves to justify the division of the Lepidoptera into two main groups.

Notwithstanding the importance attached by the author to the neuration of insects and to the desirability of establishing a uniform system of nomenclature for the wing-veins, which he bases largely on the system adopted by Redtenbacher, he is content to refer for details to his essay on evolution and taxonomy. This, we think, is a great mistake. He has adopted an elaborate system of notation by Roman numerals, and expresses his opinion that veins iv. and vi. do not exist in the Lepidoptera, Diptera, and Hymenoptera; yet he gives no illustration of a typical wing, nor what would have been of almost equal importance, a series of typical illustrations of wings of insects of various orders, illustrating his ideas of the homologies of the wing-veins. There are, indeed, a great number of illustrations of the wings of insects, but, so far as we have noticed, all those in which the wing-veins are numbered belong to the very orders in which the typical neuration is stated by Prof. Comstock to be defective. Are we to infer that his system breaks down when applied to orders with a more complicated neuration? We do not think that special attention should have been called to a question like neuration without fuller explanations having been given in the book itself; it is not enough to refer to another.

Prof. Comstock estimates the probable number of existing species of animals at one million. We presume he must have been quoting some old estimate, in order to avoid startling his readers too much. At present there cannot be much less than half a million nominal species of insects alone on our lists; and, although a certain proportion of these will undoubtedly prove to be synonyms, yet the most moderate recent computation of the actual number of existing species of insects fixes them at 2,000,000; and many of those entomologists who are best competent to form an opinion agree with Prof. Riley in regarding 10,000,000 as no exaggerated estimate. And can it be true that there are only three kinds of true clothes-moths in North America, and even these all common European pests?

Prof. Comstock has, however, succeeded in packing an enormous amount of information of all kinds into the moderate compass of his book; nor would it be just to pass over the work of the accomplished lady, of whom her husband speaks as the "Junior Author," and whose share in the book entitles her to a place beside her predecessors, who have done so much good work, alone or conjointly, and both with pen and pencil, ever since the dawn of entomology. It

is enough to mention Madame Merian, Miss Jermyn, Miss Catlow, Frau Lienig, Mrs. W. F. Kirby, and Miss Ormerod, the last of whom is still with us and by no means one of the lesser names among our English entomologists.

"Nearly all of the woodcuts have been engraved from nature by the Junior Author. . . . . Although the chief work of the Junior Author has been with the pencil and graver, many parts of the book are from her pen." So writes Prof. Comstock; and the excellence of the work can speak for itself. All the illustrations, however, are not new, nor was it necessary or desirable that they should be. Thus, the illustrations of scale-insects are taken from one of Prof. Comstock's reports on the subject; and at p. 68 Lyonnet's figures of the muscles of the larva of *Cossus ligniperda* (the Goat Moth) are reproduced, which we do not remember to have seen in any recent popular work on entomology. The woodcuts are numbered up to 757; but several of them are repeated twice, and, in one instance, even three times in different parts of the book, a proceeding which, though far from indefensible, is yet fairly open to criticism.

Much information about the habits of insects is scattered through the book, and a great many typical American forms are figured and fully described, especially among the Lepidoptera and the other orders which are most fully discussed. But, although we are fully in accord with the author as to the extent of the field of entomology and the desirability of original observation in any promising direction, yet we cannot quite agree with his concluding remarks:—"There is a large literature concerning the intelligence of bees; but those who love to see rather than merely to think about interesting things will find keenest pleasure in intimate associations with these little communists." Surely study and observation must go hand-in-hand, or we shall merely repeat and, perhaps, misunderstand what others have often observed and probably misinterpreted before us; whereas, if we know what has already been done, we need waste no time in going over old ground, but proceed at once and intelligently to the study of points which still require verification or elucidation.

We must now take our leave of a book which, though not perfect in all points (as what book is?), is yet one of the most important general introductions to entomology which have come under our notice; while, as regards most orders of insects, it will prove of great value, not only to those interested in entomology in general, but to specialists as well. We must not forget to add that there is a good index, as well as a table of contents. Few books are now published without the former; but, unfortunately, some recent authors seem to undervalue the importance of the latter.